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# E-Waste Management in Kenya: Challenges and Opportunities

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## ABSTRACT

The production and use of Electrical and Electronic Equipment (EEE) continues to grow in both developing and developed countries therefore increasing the amount of Waste Electrical and Electronic Equipment (WEEE) at its End-of-Life (EoL). This is exacerbated by the rapid growth and development in the Information and Communications Technology industry. The growth in WEEE has brought a number of challenges including introducing effective management practices that are environmentally sound to reduce its negative impact on human health and the environment as a result of pollution. Management of WEEE in most developing countries including Kenya is done through the informal sector and this poses a great challenge. There are a number of International conventions that have been formulated to deal with the issue of WEEE due to its hazardous nature. The main aim of this research was to establish the current trends, opportunity and challenges in the management of e-waste in Kenya and make recommendations on measures to be taken to effectively manage or mitigate the effects of WEEE proliferation in Kenya. The ICT industry in Kenya is growing at a very fast rate leading to drastic increase in WEEE. The greatest challenges facing Kenya in the management of WEEE include: low citizen awareness, lack of proper policy and legislative framework including public procurement and disposal laws, inadequate infrastructure for WEEE management; high cost of brand new EEE, absence of frameworks for End-of-Life (EoL) product take-back and implementation of Extended Producer Responsibility (EPR).

**Keywords:** *E-waste, WEEE, challenges, opportunities, Kenya*

## 1. INTRODUCTION

The term e-waste was first introduced in the 1970s and 1980s following the environmental degradation as a result of hazardous products imported to developing countries [1]. The production and use of Electrical and Electronic Equipment (EEE) continues to grow in the developing countries and world-wide therefore increasing the amount of Waste Electrical and Electronic Equipment (WEEE) at its End-of-Life (EoL) ([7]; [9]). The rapid growth and development in the Information and Communications Technology industry has exacerbated the situation with proliferation of computers and mobile devices to address the rising demand. Osibanjo & Nnorom [6] contend that owing to the dynamic nature of the ICT industry, the size and computational capacity of ICT products has been going through tremendous improvement, but has consequently decreased the lifespan of these products and led to their quick obsolescence. This growth has brought with it a number of challenges including management of e-waste subsequently produced and which has negative impact on human health and the environment as a result of pollution.

Osibanjo & Nnorom [6] and Schluep et al. [8] postulate that most of the e-waste produced in developing countries is managed by the informal sector through crude means such as product reuse, crude 'backyard' recycling, disposal in landfills and burning in open fields. It is evident that some of the EEE produce highly toxic materials that when not disposed in an environmentally sound manner may cause harmful effects to human life and the environment. Research shows that computers, mobile devices and television sets will contribute approximately 9.8 million tons in e-waste stream by 2015 [1]. This increase in e-waste stream has brought a major concern to governments, environmental institutions and

individual researchers because the hazardous effect it has on human health and environmental degradation is highly significant.

ICT and other EEE are relatively expensive in the developing countries comparative to developing countries considering the poverty levels, purchasing power and low income per capita of the citizens of the developing countries. This has led to a high demand for and consumption of second-hand EEE. Some of these equipments are old and have almost reached their End-of-Life (EoL) and are usually imported illegally under the pretext of bridging the "digital divide". The products are normally imported without confirmatory testing for functionality [6] and majority of them end up being WEEE because they are unusable or cannot serve the intended purpose. The main problem is that the storage, collection, transfer and disposal of WEEE in developing countries has not been streamlined and managed in an effective manner to ensure re-use; conservation of the environment; and safety of the people involved. The infrastructure and resources required to manage WEEE and non-existent or ineffective.

E-waste, Electronic Waste, or Waste of Electrical and Electronic Equipment (WEEE) has many definitions by various researchers. Asimwe & Ake [1] define e-waste as electronic equipment that is considered to be hazardous and do not, in their functional state, serve any purpose to any intending user unless the equipment has been refurbished. It includes computers and their peripherals, consumer electronics, electrically powered components which are valuable, but hazardous and may require special handling and recycling methods. WEEE may also include some second hand products which are exported to developing countries after they have reached their End-of-Life (EoL) and do not have meaningful use.

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Schluep et al. [9] define WEEE as equipment that is no longer suitable for use and is intended for dismantling, recovery of spare parts or is destined for material recovery and recycling or final disposal.

According to Directive 2012/19/EU, WEEE means electrical or electronic equipment that is waste,

including all components, subassemblies and consumables that are part of the product at the time of discarding the waste. According to EU categories, WEEE can be classified into 10 main categories as indicated in Table 1 below.

**Table 1:** WEEE categories according to the EU directive

No	Category	Label
1	Large household appliances	Large HH
2	Small household appliances	Small HH
3	IT & telecommunications equipment	ICT
4	Consumer equipment	CE
5	Lighting equipment	Lighting
6	Electrical and electronic tools (with exception of large stationary industrial tools)	E&E tools
7	Toys, leisure and sports equipment	Toys
8	Medical devices (with the exception of all implanted and infected products)	Medical equipment
9	Monitoring and control instrument	M&C
10	Automatic Dispensers	Dispensers

Due to the hazardous nature of e-waste and transboundary movement of WEEE, a number of conventions, regulations, policies and guidelines have been put in place to manage this menace. There are two main International Conventions regulating waste management: the Basel and Bamako conventions ([4]; [1]; [9]; [7]). The Basel convention was put in place in 1992 to control the transboundary movement of hazardous wastes and their disposal. In 2006, the convention adopted new guidelines on Environmentally Sound Management (ESM) of used and end-of-life mobile phones. The Bamako convention on the ban of the imports into Africa and the control of trans-boundary movement of hazardous wastes into Africa came to force in 1998. Kenya is a signatory to both conventions and many other nations have since become parties to this convention.

Asimwe & Ake [1] conducted a research on the conceived role of the East African Community (EAC) governments in combating negative impacts of e-waste.

The results of the study indicate that the EAC governments consider e-waste to be an emerging problem, but despite awareness by governments and attempts to mitigate the problem, there are no proposed realistic, immediate and tangible solutions that can solve the problem in the near future.

## 2. RESEARCH OBJECTIVES

The objective of this research is to establish the current trends, opportunity and challenges in the management of e-waste in Kenya. Moreover, the research also intends to study the landscape and make recommendations on measures to be taken to effectively manage or mitigate the effects of e-waste proliferation in Kenya. The main goal of the research is to enlighten policy makers and government agencies on the steps that

need to be taken to effectively manage WEEE in environmentally sound ways and seize the available opportunities. The study will inform policy and guide implementers on possible mechanisms of enforcement.

The academia, civil society, donors and sponsors of e-waste management projects will also benefit from the knowledge generated.

## 3. METHODOLOGY

In this paper, the researchers perform an exploratory study and analysis of the current e-waste management trends in the Kenyan landscape, identifies challenges and opportunities with the aim of contextualizing and making sound recommendations on how to address emerging issues in WEEE management.

We will not be collecting and analyzing data at this stage.

## 4. E-WASTE MANAGEMENT IN KENYA

The ICT industry in Kenya has been growing fairly fast rate compared to other countries in the East African region. The removal of tax levies on computers; promotion of e-learning in institutions of higher learning; and the launch of the e-government strategy (2004) with the aim of mainstreaming ICT in Kenya have created a huge demand for computers and related accessories. The situation has been complicated by the rapid expansion of the telecommunication industry with high proliferation of mobile devices. In 2014, Kenya had a total of 32 million mobile subscribers as per the statistics given by Communications Authority Kenya [2]. The number of Internet users has also increased tremendously in Kenya and according to the report of the Communications Authority [2], the number of Internet users in Kenya stood at 22 million in 2014 as indicated in Table 2 below.

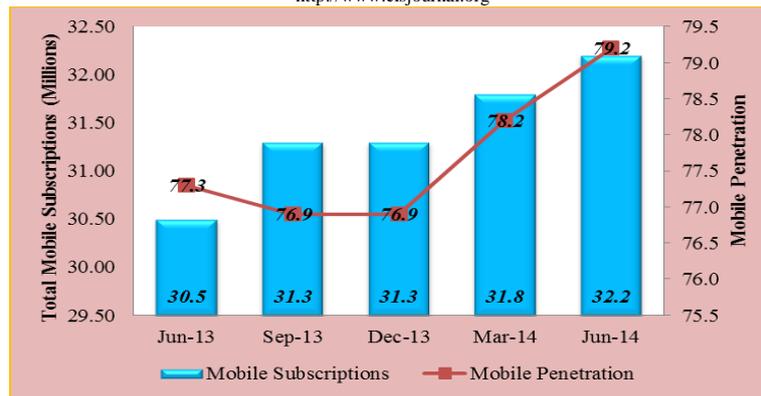
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Figure 1: Kenya mobile subscriptions (Source: CAK, 2014)

Table 2: Kenya internet subscriptions and internet users (Source: CAK, 2014)

Internet/Data Subscriptions	Jun 14	Mar 13	Quarterly Variation (%)	FY 2013/14	FY 2012/13	Annual Variation (%)
Total Internet Subscriptions	14,030,036	13,356,415	5.0	14,030,036	12,432,308	12.9
Mobile Data/Internet Subscriptions	13,930,694	13,257,309	5.1	13,930,694	12,340,005	12.9
Terrestrial Wireless Data/Internet Subscriptions	17,169	16,540	3.8	17,169	21,282	-19.3
Satellite Data/Internet Subscriptions	646	700	-7.7	646	1,278	-49.5
Fixed DSL Data/Internet Subscriptions	12,129	12,547	-3.3	12,129	11,512	5.4
Fixed Fibre Optic Data/Internet Subscriptions	69,373	69,377	0.0	69,373	58,197	19.2
Fixed Cable Modem Subscriptions	25	25	0.0	25	25	0.0
Total Internet Users	22,319,684	21,679,309	3.0	22,319,684	19,654,925	13.6

Kenya imports most of its ICT products from Britain, USA, China and Malaysia and old products are discouraged. However, there is a considerable chunk of old or refurbished products that are brought in through NGOs as donations to schools and other government institutions [1].

Mureithi & Waema [4] performed a baseline study on e-waste in Kenya between December 2007 and April 2008. The study estimates that the total e-waste generated from computers, monitors and printers alone is approximately 3,000 tonnes per year. It is envisioned that the amount of WEEE is likely to greatly increase because of the dynamics in the ICT industry and with the importation of more ICT equipment to satisfy the increasing demand. In 2010, UNEP estimated the WEEE generated annually in Kenya at 11,400 tonnes from refrigerators, 2,800 tonnes from TVs, 2,500 tonnes from personal computers, 500 tonnes from printers and 150 tonnes from mobile phones [10].

However, much of the e-waste still resides in homes, offices and storage facilities because of lack of a proper infrastructure, policy and legislative framework guiding the recycling, refurbishment and disposal of WEEE in Kenya. The local informal sector on e-waste recycling is growing with sophistication and becoming vibrant like those of Nigeria, China and India. The

downstream vendors are dismantling WEEE and re-selling or re-using the old parts for repairs. These are normally done under unregulated environments without proper regard for the safety of the people involved and the effect on the environment. The set up where these activities are carried out is usually informal, where there is no legislation and workers are prone to exploitation and poor working conditions. The main sources of parts for the downstream vendors in Kenya are refurbishes, e-waste recyclers and collectors in that order [4].

Locally, attempts to manage e-waste through recycling and refurbishment programmes have been made by firms such as Nokia, Practical Action, WEEE Centre, and Computer for Schools Kenya (CFSK), although, most of the WEEE is managed through the informal sector commonly referred to as Jua Kali ([5]; [1]). Safaricom initiated a take back scheme which failed because of location of collection centres and lack of awareness and incentives for consumers. The lack of proper disposal mechanisms has resulted in most consumers holding excessive stock of the e-waste [5].

Kenya is signatory to International conventions including: 1) the Basel convention on control of transboundary movement of hazardous wastes and their disposal; 2) the Bamako convention on the ban of the imports into Africa and the control of trans-boundary

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movement of hazardous wastes into Africa; 3) the Nairobi convention which provides a mechanism for regional (East Africa) cooperation, coordination and collaborative actions on solving pollution problems of the coastal and marine environment; 4) the Stockholm convention on Persistent Organic Pollutants (POPs); and 5) the Rotterdam convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade [5].

Kenya lacks a regularity framework and a policy for recycling and e-waste management. However, the National Environmental Management Authority (NEMA) in 2010 formulated guidelines for e-waste management to assist the government, private sector, learning institutions and other stakeholders to manage WEEE effectively and to enhance environmental conservation. These guidelines include approaches to enhance environmental protection; environmental awareness; categories of e-waste and target groups; e-waste treatment technologies; and disposal procedures [5]. Asiimwe & Ake [1] portend that the Kenyan ICT policy formulated by the Ministry of ICT (Information and Communication technology) in 2006, requires that EEE dealers demonstrate their readiness to minimize the effects of their infrastructure on the environment before they can have their licenses renewed by the Communications Authority. This in effect ensures that institutions generating e-waste have the responsibility to conserve and protect the environment from the harmful effects of WEEE.

The public sector suffers a major setback when it comes to disposal of EEE as the Public Procurement and Disposal Act which governs disposal of goods and services in public institutions does not consider the end-of-life effects of EEE procured. Public institutions have to bond and invite competitive tenders for disposal of computers and other EEE as scrap in line with procurement procedures. This bureaucratic process is slow and usually results in huge stock of obsolete computers and other WEEE being held in public institutions ([5]; [1]).

## 5. CHALLENGES FOR E-WASTE MANAGEMENT IN KENYA

Osibanjo & Nnorom [6] and Schlupe [8] portend that the greatest challenges facing developing countries in the management of WEEE include: lack of legislation and appropriate infrastructure for e-waste management, absence of frameworks for end-of-life (EoL) product take-back and implementation of extended producer responsibility (EPR). Kenya is not an exception and is faced by similar challenges.

One of the greatest challenges in the management of WEEE is the low-level of citizen awareness on the harmful effects of WEEE on the environment, their health and safety [6]. E-waste has the effect of polluting the environment when burnt or disposed without due diligence; discharging harmful heavy metals such as mercury and lead; depleting the

ozone layer; blocking water drainage channels; and causing harmful effects including cancer to living organisms in an ecosystem ([9]; [5]). The problem is compounded by the inability of most consumers to purchase brand new EEE therefore resulting in a substantial number of consumers going for second-hand or refurbished products which are cheaper but have a shorter life-span.

The government agencies dealing with waste management have limited capacity to deal with e-waste management and are not working in a co-ordinated manner that could build synergy. The government must take a multi-sectoral and multi-stakeholder approach when dealing with WEEE management in order to be effective. E-waste management has not been given the priority it deserves at a national level. There are no adequate resources and commitment towards addressing the problems and challenges associated with it. Moreover, adequate formal training has not been provided to deal with issues of WEEE management and is therefore largely handled in ad hoc manner.

Although Kenya is signatory to most of the International conventions on e-waste, just like many other developing countries, it lacks adequate regulatory framework to deal effectively with WEEE management at the local level. Moreover, there is ineffective implementation of existing regulatory and legislative framework. Besides this, as the situation is in other developing countries, the government has not put in place adequate infrastructure and resources for Environmentally Sound Management (ESM) of WEEE [9]. As a result, a lot of the e-waste is being handled by the informal sector through crude recycling, refurbishment and dismantling to extract precious metals and parts used for repair.

The government has also not streamlined mechanisms for the Local Authorities to separate WEEE from other solid wastes, store, collect, transport and process it in a structured manner. Currently, all the solid waste collected by Local Authorities is not separated into different streams to facilitate separation of WEEE and deal with its disposal in effective ways. Therefore, there is need to develop a proper waste collection system in all Local Authorities where waste is separated at the source to effectively address this challenge.

Despite the many challenges and harmful effects brought about as a result e-waste, there are many useful benefits including creating employment; generating revenue; and producing waste bi-products which can be used to feed other local industries. The informal e-waste industry creates substantial employment for the unemployed youth who on average earn approximately three dollars per day which is above the World Bank poverty level of one dollar a day ([4]; [9]). Some equipment can be dismantled and some valuable parts re-used for repairs or precious metals like gold, silver and copper reclaimed and availed for other useful purposes.

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## 6. CONCLUSION AND RECOMMENDATIONS

The Kenyan government should partner with private firms through Public-Private-Partnerships (PPP) to build robust and sustainable infrastructure to facilitate an environmentally friendly e-waste management system and provide incentives for consumers to dispose their WEEE.

This will reduce the amount of e-waste stock that consumers are piling in homes, offices and other storage facilities. The government should consider facilitating NGOs, local investors and private organizations by providing them with tax rebates and land on which to put up e-waste management facilities and infrastructure.

The government should also promote the informal e-waste sector by providing investors with funding through Constituency Development Fund (CDF), Youth, Women and Persons with Disability (PWD) funds to be used by Small and Medium Enterprises (SMEs) to improve their local communities in effort towards WEEE management. The government should provide incentives for International companies or investors who are willing to partner in refurbishment of old EEE and take-back programmes to ease the WEEE burden in the country.

The cost of procuring brand new computers is prohibitive when it comes to developing countries like Kenya and instead of total ban on used computers, the government should discourage imports; facilitate programmes for refurbishing old EEE; and lower the cost of brand new products to increase their affordability.

The government should also put in place mechanisms for tracking mass flow of WEEE in and out of the country by use of well-defined models so that it can identify their sources and distribution channels for effective management. The main source of entry of computers in Kenya is through import of (brand new and second-hand) equipment and local assembly. On the other hand, the main channels of disposing e-waste are through the second-hand market, recyclers, refurbishes and dumping as general waste [4]. However, a significant portion of this is still in the hands of consumers who do not know how to dispose it off in an environmental sound way without losing the residual value they attach to it.

In spite of the fact that NEMA has developed guidelines on e-waste management and Kenya is a party to many of the International Conventions, these guidelines and regulatory frameworks are not effective without proper national regulations and policies to govern e-waste management. The government should therefore as a matter of urgency formulate and enforce policies at a national level for effective management of e-waste. These should govern the entire e-waste management process from storage, collection to disposal and licensing of key players.

These regulations and policies should also incorporate mechanisms of enforcing the EU

recommendations requiring an extended producer responsibility (EPR) system; encourage reuse and recycling of parts and reduce environmental impact of e-waste.

The government should also take initiative to amend the public procurement and disposal laws to take cognisance of the emerging environmental and safety issues associated with WEEE management and introduce a more environmentally sound policy. This will ease the burden of e-waste stocks piling in public institutions because of the slow and bureaucratic procurement and disposal processes which do not take cognisance of the emerging challenge of WEEE.

Another serious challenge that is faced by the country is low citizen awareness on the hazards of WEEE and its negative impact on the environment. In order for the government to achieve its objective of effective WEEE management and have a greater impact, it must create awareness and encourage citizen participation through deliberate and specific marketing and campaign strategies geared towards reaching out to citizens.

Capacity building programmes should be launched in the WEEE management sector from the funds generated from fees levied on EEE imports and licensing fees from recyclers and refurbishment plants. The capacity development initiatives should be done at a national level with the involvement of experts and institutions of higher learning. Benchmarking with other countries that have been successful in management of e-waste should be done and best practices adopted to boost the government efforts

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